भारतीय मानक
Indian Standard

IS 17753 : 2021

प्रोसेस्ड तरल खाद्य और पेय पदार्थ की पैकेजिंग में उपयोग हेतू पेपर आधारित लैमिनेटेड/बहिर्वेधित बहुपरत संमिश्र (कीटाणु रहित और गैर कीटाणु रहित) गत्ते का डब्बा — विशिष्टि

Paperbased Multilayer Laminated/Extruded Composite Cartons (Aseptic and Non-Aseptic) for Processed Liquid Food Products and Beverages — Specification

ICS 85.060; 85.080

© BIS 2021

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

December 2021 **Price Group 5**

Paper Based Packaging Materials Sectional Committee, CHD 16

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Paper Based Packaging Materials Sectional Committee, had been approved by the Chemical Division Council.

Packaging of food product is a critical requirement for food processing industries to ensure that the food product will reach to common consumer in safe, sound, uninfected and intact condition. For ensuring such requirement, food products are preferably packed in impermeable packaging material. Hence, the first and foremost choice is rigid packaging materials like metal and glass. However, due to economic aspects of metal and glass based packaging, the plastic based packaging materials are mostly preferred not only because of its economical aspect but also due to easy availability, printability, functional properties and recyclability. However, certain plastic based packagings are neither renewable nor recyclable and quantum of disposal of such packaging is a major concern to the environment.

In view of emerging need for paper based composite materials for packaging of liquid food products and beverages, paper based composites got an entry into the national and international market. Such packaging are not only environment friendly but also coupled with technological developments. Hence, committee responsible for development of standards on paper based packaging felt the need to outline a standard on paper based multilayer laminated/extruded composite cartons for liquid food products and beverages. This standard is intended to define the quality of paper based multilayer laminated/extruded composite cartons for packaging of liquid food products and beverages like milk, butter milk, flavored milk, lassi, fruit juices, puree, ORS, soups, alcoholic beverages, edible oils, Ghee etc. that are processed either aseptically or non-aseptically.

There are three main components in paper based multilayer laminated/extruded composite cartons. Paperboard is the main material in composite cartons. It provides stability and strength. Polyethylene protects against outside moisture and enables the paperboard to stick to the aluminium foil. Aluminium foil protects against oxygen and light to maintain the nutritional value and flavours of the food in the package.

The composition of technical committee responsible for formulation of this standard is given in Annex F.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PAPERBASED MULTILAYER LAMINATED/EXTRUDED COMPOSITE CARTONS (ASEPTIC AND NON-ASEPTIC) FOR PROCESSED LIQUID FOOD PRODUCTS AND BEVERAGES — SPECIFICATION

1 SCOPE

This standard prescribes requirements, methods of sampling and tests for paper based multilayer laminated/extruded composite cartons (aseptic and non-aseptic) for processed liquid food products and beverages.

2 REFERENCES

The Indian Standards given in Annex A contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

3 TERMINOLOGY

For the purpose of this standard, the definitions of terms given in IS 4261, IS 2828 and IS 7019 in addition to the following shall apply.

3.1 Food Grade Material — The material made of substances which are safe and suitable for their intended use and shall not endanger human health or result in unacceptable change in the composition of the food or organoleptic characteristics which come into contact with.

3.2 Paper Based Multilayer Laminated/Extruded Composite Cartons — The carton made up of combination of paper board, polyethylene and aluminum foil to form a laminated/extruded composite structure for packaging of liquid food and beverages (such as dairy products, edible oil, ghee, juice, alcoholic beverages, non-dairy beverages, non-dairy cream, puree etc.) which are processed either aseptically or non-aseptically.

3.3 Overall Migration Limit — The maximum permitted amount of non-volatile substances like monomer, additives, pigments etc leaches or migrated from a plastics material or article into food simulants.

3.4 Specific Migration Limit — The maximum permissible amount of heavy metals like, Barium (Br), Cobalt (Co), Copper (Cu), Iron (Fe), Lithium (Li), Manganeze (Mn) , Zinc (Zn) etc which has got hazardous effect to human health, leaches or migrated from plastics packaging material into food products.

3.5 Water Vapour Transmission Rate (WVTR) — The rate at which water vapour passes through a multilayer composite from one side to another side, usually expressed in grams per square metre per 24 h under specified conditions of temperature and relative humidity.

3.6 Oxygen Gas Transmission Rate (OTR) — The rate at which oxygen gas molecules passes through a multilayer composite from one side to another side, usually expressed in cubic centimetre per square metre per 24 h under specified conditions of temperature and atmospheric pressure.

4 MATERIALS AND CONSTRUCTION

4.1 The carton shall be made of paper based multilayer composite sheet. The composite sheet shall be made of paper board in combination with polyethylene film and/or aluminum foil. The inner liner of composite sheet shall always be of polyethylene for sealing purpose. Number of layers/ply of multilayer composite sheet shall be either 3-ply or 5-ply or 6-ply based on the desired shelf life of the product. The individual layers of substrate of the composite sheet shall confirm to parameters as given in Table 1.

Table 1 Requirements for Components of Composite Sheet

(*Clauses* 4.1, 4.1.1, 4.1.2 *and* 4.1.3)

Layer	Requirement	Method of Test
Grammage of paperboard, g/m^2, *Max*	450	IS 1060 (Part 5/Sec 5)
Thickness of aluminium foil, microns, *Max*	9.7	Annex A of IS 8970
Thickness of polyethylene, microns, *Max*	110	Annex A of IS 2508

NOTES

1 Aluminium foil may or may not used for construction of composite carton meant for packaging of processed liquid food under non-aseptic conditions.

2 During the formation of pack on form-fill and seal machine, no adhesive will be used to bond the material rather polyethylene layer will act for bonding purpose between two layers and it will be ultrasonic heat sealed.

4.1.1 *Paper Board*

The paper board used for manufacturing of paper based multilayer laminated/extruded composite cartons shall confirm to IS 16983 or IS 1776 or IS 12999 except for the requirement of grammage. The grammage shall be as given in Table 1. In addition, the paper board shall be OBA (Optical brightening agent) free, and anthraquinone shall not be used in pulp which is used for making paper board. The paper board shall be of virgin material.

4.1.2 *Polyethylene*

The polyethylene used shall be made from materials LDPE conforming to IS 2508, LLDPE conforming to IS 14500 (or a blend thereof) co extruded film except for the requirement of thickness. The thickness shall be as given in Table 1 above. Polyethylene shall meet the food grade requirements given in IS 10146 and IS 16738.

4.1.3 *Aluminium Foil*

Aluminium foil used for manufacturing of paper based multilayer laminated/extruded composite cartons shall confirm to clause **4.3** of IS 8970 except for the requirement of thickness. The thickness shall be as given in Table 1.

4.1.4 Caps shall be made of polypropylene and its copolymers as per IS 10910 for its safe use in contact with liquid foodstuffs.

4.1.5 Drinking Straws shall be made of polypropylene and/or its co-polymer and/or paper based and should be safe to use in contact with liquid foodstuff.

4.1.6 For printing ink application, practices as per IS 15495 shall be followed.

4.2 Composite Cartons Construction

The composite cartons shall be formed, filled and sealed on the suitable form, fill and sealing machine.

4.3 Capacity

The composite cartons shall be in 65 ml, 70 ml, 90 ml, 125 ml, 150 ml, 160 ml, 180 ml, 200 ml, 250 ml, 330 ml, 500 ml and 1000 ml capacity or any other capacity as agreed by the buyer and manufacturer.

5 REQUIREMENTS

5.1 Requirements for Paper Based Multilayer Laminated/Extruded Composite Sheets

5.1.1 *Description*

The sheets shall be uniform in texture, finish, free from pin-holes, streaks, tears, blisters, particles of foreign matter. There shall be no other visible defect. The sheet shall show no impression of handling on the surface of the sheet. The sheet shall have even and wrinkle-free surface. The sheet shall be free from any extraneous odour.

5.1.2 The sheets shall be supplied in reels packed to protect from any extraneous dust hazards.

5.2 Requirements for Paper Based Multilayer Laminated/Extruded Composite Cartons

5.2.1 *Over-all Migration*

Paper based multilayer laminated/extruded composite cartons with inner plastic layer which will be in contact with liquid food shall be subjected to migration test as per IS 9845. The paper based multilayer composite cartons shall pass the prescribed over-all migration limit of 60 mg/kg or 10 mg/dm^2 when tested as per specified test method with no visible colour migration.

5.2.2 *Specific Migration Test*

5.2.2.1 Paper based multilayer laminated/extruded composite cartons shall not release the specific heavy metal substances from inner plastic layer in contact with liquid food in quantities exceeding the specific migration limits listed in Table 2.

5.2.2.2 The sample shall be prepared using the procedure described in IS 9845, for toxic substances mentioned at sl no. i) to viii) of Table 2.

5.2.2.3 Specific migration of toxic substances (Sl No. i to x) shall be determined according to the appropriate method prescribed in Table 2.

Table 2 Limits for Specific Migration

(*Clauses* 5.2.2.1, 5.2.2.2 *and* 5.2.2.3)

Sl No.	Substances	Test Method	Migration Limit (mg/Kg), *Max*
(1)	(2)	(3)	(4)
i)	Barium	IS 3025(Part 2)	1.0
ii)	Cobalt	-do-	0.05
iii)	Copper	-do-	5.0
iv)	Iron	-do-	48.0
v)	Lithium	-do-	0.6
vi)	Manganese	-do-	0.6
vii)	Zinc	-do-	25.0
viii)	Antimony	A-4 of IS 5158	0.04
ix)	Phthalic acid, (2-ethylhexyl) ester (DEHP)	IS 9873(Part 6)	1.5

5.2.3 *Vibration Leakage Test*

The paper based multilayer laminated/extruded composite cartons shall be filled and sealed as in the actual filling and sealing process. The filled composite cartons shall be subjected to vibration test as given in Annex B.

The lot shall be considered passing in the test, if not more than one paper based multilayer laminated/extruded composite carton show leakage in the test. In the event of leakage of more than one paper based multilayer laminated/extruded composite cartons, a retest involving the same quantities as per Annex B shall be taken and tested for vibration leakage test. The lot shall be considered passing in the retest if not more than one paper based multilayer laminated/extruded composite carton shows leakage, otherwise the lot shall be rejected.

5.2.4 *Storage Test*

5.2.4.1 Paper based multilayer laminated/extruded composite cartons, filled with liquid food shall be tested for storage properties.

5.2.4.2 The storage test shall be carried out at 38 ± 1 °C and 90 ± 2 percent RH (accelerated conditions) and 27 ± 1 °C and 65 ± 2 percent RH (standard conditions). The rancidity of the contents when determined as per the method given in IS 8639 shall be noted initially and also at the end of number of days declared as shelf life under standard conditions and at the end of 3 times the number of days declared as shelf life under accelerated conditions (*see* Note below).

The composite cartons shall be accepted if there is no delamination, no leakage, no deformation and the liquid food does not show the rancidity at the end of days declared as shelf life under standard conditions and at the end of 3 times the number of days declared as shelf life under accelerated conditions.

NOTE — For example, if declared shelf life of liquid food is 30 days, the rancidity of the contents shall be noted initially and at the end of 30 days under standard conditions and at the end of 90 days (3 × 30) under accelerated conditions.

5.2.5 *Water Vapour Transmission Rate (WVTR) and Oxygen Transmission Rate (OTR)*

5.2.5.1 The paper based multilayer laminated/extruded composite sheet corresponding to composite cartons passing the storage tests shall be tested for water vapour transmission rate (WVTR) according to Annex C or ISO 2528 and Oxygen transmission rate according to ISO 15105-2.

5.2.5.2 The requirements shall be declared by manufacturer of paper based multilayer laminated/extruded composite sheet based on **5.2.5.1**. Samples shall assessed on declared value.

5.2.6 *Print Resistance Test*

The printed paper based multilayer laminated/extruded composite cartons when tested in accordance with the method given in Annex D shall not show any significant removal of the print from the surface and the print shall be legible to the naked eye after the test.

NOTE — Print resistance test will not be applicable to composite cartons where outer surface of the carton is laminated/extruded with plastic film.

5.2.7 Ink Adhesion Test — The printed matter on the paper based multilayer laminated/extruded composite cartons when tested in accordance with the method given in Annex E shall be still legible.

NOTE — Ink adhesion test will not be applicable to composite cartons where outer surface of the carton is laminated/extruded with plastic film.

6 PACKING AND MARKING

6.1 Packaging

The paper-based multilayer laminated/extruded composite cartons shall be securely and suitably packed as per the requirements of the Food Safety (Standards) Packaging Regulations, 2020 and the Food Safety (Standards) Labelling Regulations, 2019, and the *Legal Metrology Act*, 2009 and the rules framed thereunder.

6.2 Marking

6.2.1 Each package shall be marked as per the requirements of the Food Safety (Standards) Packaging Regulations, 2020 and the Food Safety (Standards) Labelling Regulations, 2019, and the *Legal Metrology Act*, 2009 and the rules framed thereunder.

6.2.2 Each reel comprising of paper-based multilayer laminated/extruded composite sheets intended for making composite cartons shall be marked with following details:

a) Indication of the source of manufacture;
b) Batch number; and
c) Date of manufacture.

6.2.3 *BIS Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the Conformity Assessment schemes under the provisions of the *Bureau of Indian Standards Act,* 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

7 SAMPLING AND CRITERIA FOR CONFORMITY

7.1 Sampling and Criteria for Conformity for Composite Sheets

7.1.1 *Lot*

All the reels of paper based multilayer laminated/extruded composite sheets with packs of same style, capacity and batch supplied at a time shall be grouped together to constitute a lot.

7.1.1.1 The sample size (number of reels of paper based multilayer laminated/extruded composite sheets to be sampled from each lot) is given in Table 3. To ensure randomness of selection, methods given in IS 4905 shall be followed.

Table 3 Scale of Sampling

(*Clauses* 7.1.1.1 *and* 7.1.2)

Sl No. (1)	Lot Size (2)	Sample size (3)	Acceptance No. (4)
i)	Up to 500	20	1
ii)	501 to 1200	32	1
iii)	1201 to 3200	50	2
iv)	3201 to 10000	80	3
v)	10001 to above	125	5

7.1.2 *Number of Tests and Criteria for Conformity*

The specimen from each of the reel selected in the sample, as given in Col 3 of Table 3, shall be used for testing the requirements given in **5.1.1** and **5.1.2**. The lot shall be considered as conforming to these requirements, if the number of defective samples do not exceed the acceptance number given in Col 4 of Table 3, otherwise the lot shall be rejected.

7.2 Sampling and Criteria for Conformity for Composite Cartons

7.2.1 *Lot*

The composite cartons of the same style, capacity, made from same batch of composite sheet and produced under similar conditions of production shall be grouped together to constitute a lot.

7.2.1.1 The sample size (number of paper based multilayer laminated/extruded composite cartons to be sampled from each lot) is given in Table 4. To ensure randomness of selection, methods given in IS 4905 shall be followed.

Table 4 Scale of Sampling

(*Clause* 7.2.1.1 *and* 7.2.2)

Sl No. (1)	Lot Size (2)	Sample size (6)
i)	Up to 3200	5
ii)	3201 to 10 000	8
iii)	10 001 to above	13

7.2.2 *Number of Tests and Criteria for Conformity*

The composite cartons as selected in the sample shall be tested for storage test, ink adhesion and print resistance. Any carton failing to meet any one or more of these requirements shall be termed as defective. The lot shall be considered as conforming to these requirements, if no defective is found in the sample, otherwise the lot shall be rejected.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No./Other Publication	*Title*
1060 (Part 5/Sec 5) : 2021	Methods of sampling and test for paper and allied products: Part 5 Methods of test for paper and board: Section 5 Determination of grammage
1776 : 1989	Folding box board, uncoated — Specification
2508 : 2016	Polyethylene films and sheets — Specification
2771 (Part 1) : 1990	Corrugated fibreboard boxes — Specification: Part 1 General requirements
2828 : 2019	Plastics — Vocabulary
3025 (Part 2) : 2019	Methods of sampling and test (physical and chemical) for water and wastewater: Part 2 Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES)
4905 : 2015	Random sampling and randomization procedures
4261 : 2001	Glossary of terms relating to paper and ulp-based packaging materials
5158 : 1987	Specification for phthalic anhydride, technical
7019 : 1998	Glossary of terms in plastics and flexible packaging, excluding paper
7028 (Part 2) : 2002	Performance tests for complete, filled transport packages: Part 2 Vibration test at fixed low frequency
8639 : 1977	Code for evaluation of the effect of packaging and storage on the sensory qualities of foods and beverages
8970 : 1991	Aluminium foil laminate for packaging — Specification
9845 : 1998	Determination of overall migration of constituents of plastics materials and articles intended to come in contact with foodstuffs — Method of analysis
9873 (Part 6) : 2017	Safety of toys: Part 6 Determination of certain pthalate esters in toys and children's products
10146 : 1982	Polyethylene for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
10910 : 1984	Polypropylene and its copolymers for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
12999: 1990	Folding box board, coated — Specification
14500 : 1998	Linear low density polyethylene (LLDPE) films
15495 : 2020	Printing ink for food packaging — Code of practice
16738 : 2018	Positive list of constituents for propylene, Polyethylene and their copolymers for its safe use in Contact with foodstuffs and Pharmaceuticals
16983 : 2018	Solid bleached Sulfate board — Specification
ISO 2528 : 2017 (Under process of adoption)	Sheet materials — Determination of water vapour transmission rate (WVTR) — Gravimetric (dish) method
ISO 15105-2: 2003 (Under process of adoption)	Plastics — Film and sheeting — Determination of gas transmission rate — Part 2: Equal-pressure method

ANNEX B

(*Clause* 5.2.3)

VIBRATION LEAKAGE TEST

B-1 VIBRATION TABLE

This shall be equipment conforming to IS 7028 (Part 2).

B-2 MODE OF PACKAGING

Paper based multilayer laminated/extruded composite cartons shall be packed upside in corrugated fibre box conforming to IS 2771 (Part 1).

B-3 CONDITIONING

The box containing the paper based multilayer laminated/extruded composite cartons filled with liquid food shall be left under ambient conditions to attain room temperature. In case of dispute, the ambient condition shall be 27 ± 2 °C and 65 ± 2 percent relative humidity.

B-4 PROCEDURE

Four corrugated fibre boxes containing the paper based multilayer laminated/extruded composite cartons filled with processed liquid food and beverage shall be kept on the vibration table and vibrated at a peak acceleration of slight above 1*g* for 30 min. After the test, the paper based multilayer laminated/extruded composite cartons are examined for apparent leaks and leaking composite cartons are to be removed. The remaining composite cartons are wiped clean and placed on flat blotting paper on the vibration table at 2 Hz for 10 min and the composite cartons are examined for apparent leaks, leaking composite cartons are to be counted and added to the leaking cartons.

B-5 CRITERIA FOR ACCEPTANCE AND RETESTING

The lot shall be considered passing in the test, if not more than one paper based multilayer laminated/extruded composite carton show leakage in the test. In the event of leakage of more than one paper based multilayer laminated/extruded composite cartons, a retest involving the same quantities as per **B-4** shall be taken and tested for vibration leakage test. The lot shall be considered passing in the retest if not more than one paper based multilayer laminated/extruded composite carton shows leakage, otherwise the lot shall be rejected.

ANNEX C

(*Clause* 5.2.5.1)

DETERMINATION OF WATER VAPOUR TRANSMISSION RATE (WVTR)

C-1 GENERAL

This method is an instrumental method for determining the water vapour transmission rate of multi-layer composite structures using an infrared detection sensor.

C-2 PRINCIPLE

A dry chamber, at a specified relative humidity, is separated from a wet chamber, in which the atmosphere is saturated with water vapour at a known temperature, by a sheet of the material to be tested. The change in humidity brought about by water vapour transmitted through the specimen is detected by an infrared sensor capable of providing an electrical output signal which is a measure of the relative humidity in the dry chamber. The time taken to reach a steady state is measured and converted into a water vapour transmission rate.

C-3 TEST SPECIMENS

The specimens shall be representative of the material, be free from wrinkles, creases and pinholes, and have uniform thickness. Each specimen shall have a larger area than the transmission area of the cell used for the test, and shall be hermetically mounted. Three specimens shall be used unless otherwise specified or agreed between the interested parties. Unless otherwise specified, determine the thickness of each specimen at three points that are equally spaced.

C-4 CONDITIONING

Condition the specimens at 27 °C ± 2 °C and a relative humidity of (65 ± 5) percent. The period of conditioning shall be as stated in the relevant specification for the material.

C-5 APPARATUS AND TEST CONDITIONS

C-5.1 The apparatus includes a transmission cell with two chambers, a lower (high-humidity) chamber and an upper (low-humidity) chamber between which a specimen is mounted, an infrared sensor for determining the relative humidity in the upper chamber, a pump for circulating the air in the upper chamber through the sensor, a flow meter, a drying tube and switch valves.

C-5.2 The transmission area shall be between 5 cm^2 and 100 cm^2. The specimen shall never be able to touch the upper or lower inside surface of the transmission cell. The temperature of the transmission cell shall be kept within ± 0.5 °C of the test temperature by means of a temperature controller.

C-5.3 The flow meter shall be capable of measuring flow rates from 5 ml to 100 ml per minute.

C-5.4 The infrared detection sensor shall be capable of detecting a change in water vapour content of either 1 µg per litre or 1 mm^3/dm^3 (1 ppm by volume).

For each type of humidity sensor, the appropriate maintenance and calibration procedures shall be followed as specified by the manufacturer.

C-5.5 The drying tube shall be capable of drying air down to the detection limit of the infrared sensor or lower.

C- 5.6 The test conditions should preferably be chosen from those given in Table 5.

Table 5 Choice of Test Conditions

(*Clause* C-5.6)

Set of Test Conditions	Temperature °C	RH Percent
1	25 ± 0.5	90 ± 2
2	38 ± 0.5	90 ± 2
3	40 ± 0.5	90 ± 2
4	23 ± 0.5	85 ± 2
5	25 ± 0.5	75 ± 2

C-6 PROCEDURE

C-6.1 Measure the water vapour transmission rate of a reference specimen and then each test specimen as described in **C-6.2** to **C-6.5**. The water vapour transmission rate of the reference specimen shall be checked periodically, preferably once or twice a year. Each laboratory or test site shall maintain and utilize their own reference specimens.

C-6.2 Measure the zero-level voltage of the apparatus using dried air.

C-6.3 Prepare a saturated solution suitable for maintaining the humidity at the required level, and introduce it into the lower chamber together with some cotton wool.

NOTE — A relative humidity of (90 ± 2) percent is produced by a saturated solution of either zinc sulfate or ammonium dihydrogen phosphate. A relative humidity of (85 ± 2) percent is produced by a saturated solution of potassium chloride. A relative humidity of (75 ± 2) percent is produced by a saturated solution of sodium chloride or sodium acetate.

C-6.4 Mount the reference specimen or test specimen hermetically between the upper and lower chambers, taking care that there are no wrinkles or slackness in the specimen.

C-6.5 Fit the transmission cell in the apparatus and then allow dry air to flow through the upper chamber at the specified flow rate. Monitor the output voltage from the infrared sensor until it reaches a steady state in which it is constant to within ± 5 percent.

NOTE — The flow rate should be specified by the manufacturer of the apparatus.

If the voltage is not constant to within ± 5 percent, this shall be indicated in the test report.

C-7 CALCULATION

Calculate the water vapour transmission rate of each test specimen using the following equation:

$$\mathrm{WVTR} = \frac{S \times (\mathrm{Er} - \mathrm{Eo})}{(\mathrm{Er} - \mathrm{Eo})} \times \frac{\mathrm{Ar}}{\mathrm{As}}$$

where

WVTR = the water vapour transmission rate of the test specimen, expressed in grams per square metre 24 h [g/(m^2.24 h)];

Eo = the zero-level voltage, in volts, of the apparatus using dried air;

Er = the steady-state voltage, in volts, measured with the reference specimen;

S = the water vapour transmission rate of the reference specimen, in g/(m^2.24 h);

Es = the steady-state voltage, in volts, measured with the test specimen;

Ar = the transmission area, in square metres, of the reference specimen; and

As = the transmission area, in square metres, of the test specimen.

C-8 TEST RESULT

Calculate the test result as the arithmetic mean of the results obtained for each test specimen, rounding to the second place of decimals if the value is less than one, and to two significant figures if the value is greater than one.

ANNEX D

(*Clause* 5.2.6)

TEST FOR PRINT RESISTANCE OF PRINTED CARTONS

D-l Leave the paper based multilayer laminated/extruded composite cartons to stand for at least 24 h after printing.

D-2 Smear the paper based multilayer laminated/extruded composite cartons, or representative section cut from the printed area with liquid food intended to be packed in at ambient conditions and leave it for 1 h.

D-3 Wash the paper based multilayer laminated/extruded composite cartons or its representative section with cold water.

D-4 Rub each paper based multilayer laminated/extruded composite carton or representative section firmly with hard paper tissue ten times.

D-5 There shall be no significant removal of the print from the surface of the paper based multilayer laminated/extruded composite carton and the print shall be legible to the naked eye after the test.

ANNEX E

(*Clause* 5.2.7)

TEST FOR INK ADHESION OF PRINTED CARTONS

E-1 Apply two strips of 25 mm wide transparent pressure sensitive taps or cello-tape to the printed area of the paper based multilayer laminated/extruded composite carton. One piece down the length of the carton and the other along the width.

E-2 Press the tape firmly on to the paper based multilayer laminated/extruded composite carton and leave for 15 s.

E-3 Remove the tape by pulling slowly at about 10 mm/s from one end at about 90° to the paper based multilayer laminated/extruded composite carton surface.

E-4 There shall be no significant removal of the print from the surface of the paper based multilayer laminated/extruded composite carton and the printed material shall be still legible.

ANNEX F

(*Forward*)

COMMITTEE COMPOSITION

Paper Based Packaging Materials Sectional Committee, CHD 16

Organization	*Representative(s)*
In personal capacity	Dr N. C. Saha (***Chairman***)
B & A Packaging (I) Ltd, Kolkata	Shri Amal Kumar Mohanty Shri Tapan Kr Chand (*Alternate*)
CPPRI, Saharanpur	Dr M. K. Gupta Dr Sanjay Tyagi (*Alternate*)
Dr Reddy laboratories, Hyderabad	Shri Avinash Talwar Shri Vinay Kr Singh (*Alternate*)
Khatima fibres, Khatima	Shri R. C. Rastogi
Federation of Corrugated Box Manufacturers of India, Mumbai	Shri Satish Tyagi Shri K. P. Singh (*Alternate*)
Federation of paper convertors of India, New Delhi	Shri Mukesh Gupta Shri Sushil Kumar Singh (*Alternate*)
Indian Institute of Packaging, Mumbai	Dr Tanweer Alam Shri Madhab Chakraborty (*Alternate*)
Indian Institute of Technology, Roorkee	Dr Dharm Dutt Dr Kirtiraj K. Gaikwad (*Alternate* I) Dr Vibhor Kumar Rastogi (*Alternate* II)
Indian Paper Manufacturers Association, New Delhi	Mr Biswaranjan Dash Mr Rohit Pandit (*Alternate*)
Indian Agro & Recycled Paper Mills Association, New Delhi	Dr B. P. Thapliyal Dr Anil Naithani (*Alternate*)
ITC Life Sciences, Bangaluru	Shri Ajith Kumar Dr Kamal (*Alternate*)
ITC, Bhadrachalam	Shri Chidambara Vinayagam Shri P. N. Sridharr (*Alternate*)
J K Paper, New Delh	Shri Mahesh Narayan Bhat Shri Aayush Srivastava (*Alternate*)
Kumar Printers, Gurugram	Shri Sandeep Bhargava Shri Vinod Kaushik (*Alternate*)
Nestle India Ltd, Gurugram	Shri Barun Banerjee Shri Deepak Singh (*Alternate*)
Package Design Research and Test Lab, Moradabad	Shri L. M. Gupta Shri Mayank Gupta (*Alternate*)
Prem Industries, Ghaziabad	Shri Alok Goel Shri H. P. Singh (*Alternate*)
Suprabha Protective Products Pvt Ltd, Pune	Shri P. R. Bantwal Ms Rachel Jacob (*Alternate*)
Tetra Pak India Pvt Ltd, Gurugram	Shri Sharad Sharma Shri Jaideep Gokhale (*Alternate*)
Uflex Limited, Noida	Shri Ashvani Sharma Shri Rakesh Sharma (*Alternate*)

Organization	*Representative(s)*
Safepack Industries Limited, Pune	Shri Rajendra Tapadia Shri Anand Tapadi (*Alternate*)
Century Pulp & Paper Limited, Nainital	Shri Sanjay Kumar Yadav Shri Sunesh Yadav (*Alternate*)
Yash Papers, Faizabad	Shri Jagdeep Hira
Stora Enso, Gurugram	Shri Sanjeev Khandelwal
Parksons Packaging, Rudrapur	Shri Srikanth Ramamurthy Shri Pawan Kumar Singh (*Alternate*)
Siegwerk, Bhiwadi	Shri Jatin Thakkar Priyanka Baweja (*Alternate*)
Hersheys India Pvt Ltd, Mumbai	Ms Deepa Mandar Naik
BIS Directorate General	Shri A. K. Lal, Scientist, 'E' and Head (CHD) [Representing Director General (*Ex-officio*)]

Member Secretary

Shrishti Dixit
Scientist 'D' (CHD), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: CHD 16 (14843).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	2323 7617 2323 3841
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi KOLKATA 700054	2337 8499, 2337 8561 2337 8626, 2337 9120
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg CHANDIGARH 160019	265 0206 265 0290
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	2254 1216, 2254 1442 2254 2519, 2254 2315
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	2832 9295, 2832 7858 2832 7891, 2832 7892

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi